

Fan coil controller TRA-F22x-A

Fan coil controller for 3-speed fans with modulating valves and two external inputs standalone, BACnet MS/TP or Modbus.

General Description

The TRA-F22x-A is an electronic fan coil controller for room temperature control. It supports motorized valves and 1- or 3-speed fans in 2-pipe and 4-pipe fan coil units for heating or cooling. Additional inputs can be used for an external temperature sensor, room occupancy (motion) detection and other functions. The controller offers Comfort, Economy and Protection operating modes. The TRA-F221-A includes a MODBUS RTU and the TRA-F222-A a BACnet MS/TP interface. Both types can be easily integrated into a building automation system.

Typical application includes:

- Fan coil systems
  - 2-pipe fan coil (cooling or heating on/off or modulating valves)
  - 2-pipe fan coil with 3-point valve (cooling or heating valve)
  - 2-pipe fan coil and electric heater
  - 4-pipe fan coil (cooling and heating on/off or modulating valve)
- Floor heating systems (on/off or 3-point valve)
- Chilled/Heated ceilings or chilled beams systems (on/off or 3-point valve)

Features

- LCD display with backlight
- Room temperature control via built-in temperature sensor
- 2 configurable inputs temperature or digital
- 2 analog outputs for modulating valve control or analog fan
- 3 digital outputs for 1- or 3-speed fan control or digital valves (on/off or 3-position valve)
- Comfort, Economy and Protection operating mode
- Display of current room temperature or temperature set point in °C or °F
- Display of outdoor temperature received via Modbus or BACnet
- Manual or automatic heating / cooling changeover
- Select operating mode via operating mode button on the controller
- Minimum and maximum limitation of room temperature set point
- Floor heating temperature limitation
- Key lock function
- BACnet MS/TP interface (TRA-F222 only)
- RTU Modbus slave interface (TRA-F221 only)
- Reload default settings for commissioning and control parameters
- 100…240 VAC operating voltage
- Flush mount on all 75x75x35mm wall mounting box or larger boxes
- Selection of application via parameter
- No data loss on power fail

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Types and Ordering

Product Name	Product No.	Description / Type	Size / Length	Weight
Controller				
TRA-F220-A	40-100274	Fan coil controller standalone	88 x 88 x 41 mm (3.5 x 3.5 x 1.6 in)	168 g (5.92 oz)
TRA-F221-A	40-100256	Fan coil controller with Modbus	88 x 88 x 41 mm (3.5 x 3.5 x 1.6 in)	168 g (5.92 oz)
TRA-F222-A	40-100311	Fan coil controller with BACnet	88 x 88 x 41 mm (3.5 x 3.5 x 1.6 in)	168 g (5.92 oz)
Installation box (optional)				
AMB-001	40-510009	Flush mounting installation box	80 x 80 x 40 mm (3.2 x 3.2 x 1.6 in)	40 g (1.41 oz)
AMB-006	40-510101	Surface mounting installation box	82 x 82 x 36 mm (3.2 x 3.2 x 1.4 in)	41 g (1.44 oz)
Passive temperature sensor with flying lead (NTC 10kΩ at 25 ºC (77 °F))				
S-Tn10-2	40-200001	-	2 m (6 ft.) PVC cable	-
S-Tn10-6	40-200142	-	6 m (19 ft.) PVC cable	-
Passive temperature sensor for duct mounting (NTC 10kΩ at 25 ºC (77 °F))				
SD-Tn10-12-2	40-200002	12 cm (4.7 inch) probe	2 m (6 ft.) PVC cable	-
SD-Tn10-20-2	40-200003	20 cm (7.8 inch) probe	2 m (6 ft.) PVC cable	-
SDB-Tn10-12-1	40-200124	12 cm (4.7 inch) probe	-	-
SDB-Tn10-20-1	40-200133	20 cm (7.8 inch) probe	-	-
Passive temperature sensor for contact mounting on pipes (NTC 10kΩ at 25 ºC (77 °F))				
SC-Tn10-2	40-200095	-	2 m (6 ft.) PVC cable	-
SC-Tn10-6	40-200159	-	6 m (19 ft.) PVC cable	-
Passive temperature sensor for indoor mounting (NTC 10kΩ at 25 ºC (77 °F))				
SRA-Tn10	40-200005	Indoor temperature sensor	88 x 88 x 21 mm (3.5 x 3.5 x 0.8 in)	-
Passive temperature sensor for outdoor mounting (NTC 10kΩ at 25 ºC (77 °F))				
SOD-Tn10-1	40-200108	Outdoor temperature sensor	64 x 64 x 36 mm (2.5 x 2.5 x 1.4 in)	-

Additional sensors and accessories can be found on the Vector Controls home page www.vectorcontrols.com.

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Technical Specifications

Caution! This device is intended to be used for comfort applications. Where a device failure endangers human life and/or property, it is the responsibility of the owner, designer and installer to add additional safety devices to prevent or detect a system failure caused by such a device failure. Vector Controls or its affiliates cannot be held liable for any damage caused by such a failure. Failure to follow specifications and local regulations may endanger life, cause equipment damage and void warranty.

Power supply	Power requirements	100…240 VAC, 50/60 Hz
	Power consumption	Max. 5 VA
	Electrical connection	Screw terminals Wire 0.15…2.05 mm2 (AWG 26…14)
Built-in sensor	Temperature range Accuracy 0…50 °C	0…50 °C (32…122 °F) 0.5 °C (1 °F)
Signal inputs	Digital and temperature input Temperature range Temperature accuracy Type & range of temperature sensor	Selectable via parameter -20…80 °C (-4…176 °F) 0.5 °C (1 °F) at 0…50 °C (32…122 °F) 1.0 °C (2 °F) at <0 °C (<32 °F), >50 °C (>122 °F) NTC (Sxx-Tn10): -40…140 °C (-40…284 °F)
Signal outputs	Relays outputs (SPST NO) Insulation strength between relays and system electronics between neighboring contacts Electronic control type	0…250 VAC, resistive load current 5A, inductive 2A 2500V to EN 60 730-1 2500V to EN 60 730-1 2.B (micro-disconnection)
	Analog outputs Output signal Resolution Maximal load	 0…10 VDC 10 bit, 9,7 mV Voltage signal: ≥1kΩ
Temperature resolution	Displayed temperature	0.1 °C (0.5 °F)
	Set point	0.5 °C (1 °F)
Network	Hardware interface Max nodes per network Max nodes per segment	RS485 in accordance with EIA/TIA 485 247 128
	Conductor wire Impedance	Shielded Twisted Pair (STP) cable 100 – 130 Ω
	Galvanic isolation	The communication circuitry is isolated
	Network topology	According Modbus manual (Modbus over serial line)
	Recommended maximum length per chain	1200 m (4000 ft.)
Modbus TRA-F221-A	Communication standard	Modbus RTU (www.modbus.org)
	Default setting	38400 baud rate, even parity, 1 stop bit
	Communication speed (baud rate)	2400, 4800, 9600, 19200, 38400, 57600, 115200
	Modbus RTU protocol (8 data bits)	no parity – 1 or 2 stop bits; even or odd parity – 1 stop bit
BACnet TRA-F222-A	Communication standard	BACnet MS/TP
	Default setting	38400 baud rate
	Communication speed (baud rate)	9600, 19200, 38400, 57600, 76800, 115200
Environment	Operation Climatic conditions Temperature Humidity	To IEC 721-3-3 class 3K5 0…50 °C (32…122 °F) <85 % RH non-condensing
	Transport & storage Climatic conditions Temperature Humidity Mechanical conditions	To IEC 721-3-2 and IEC 721-3-1 class 3K3 and class 1K3 0…50 °C (32…122 °F) <95 % RH non-condensing class 2M2
Standards	Safety class	II (IEC 61140)
	Degree of protection	IP30 to EN 60529
General	Material	Fire proof PC+ABS plastic (UL94 class V-0)
	Dimensions front part (H x W x D) Dimensions back part (H x W x D)	88 x 88 x 16 mm (3.5 x 3.5 x 0.6 in) 67 x 61 x 25 mm (2.6 x 2.4 x 1.0 in)
	Weight (including package)	250 g (8.81 oz)

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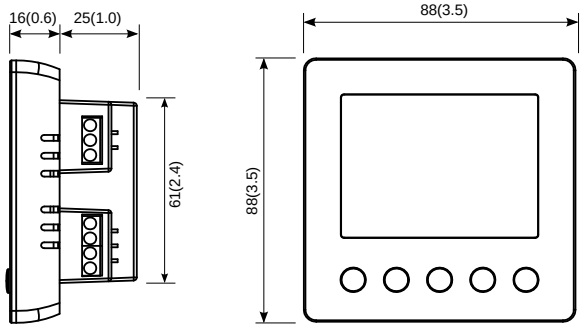
Product testing and certification

CE Declaration of Conformity

Information on the conformity of our products can be found on our website www.vectorcontrols.com on the corresponding product page under "Downloads".

Dimensions, mm (inch)

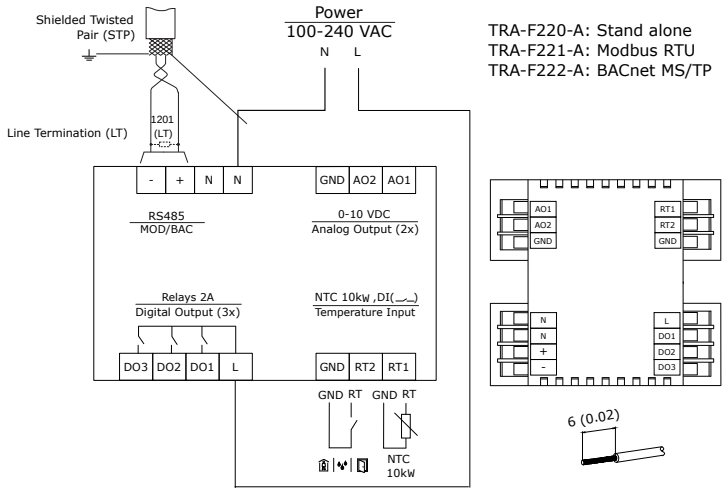


ⓘ For flush mounting, a 75 x 75 x 35 mm (3.0 x 3.0 x 1,4 inch) installation box or larger must be used. See section "Types and Ordering" for recommended installation boxes.

Connection diagram

The wiring for the different predefined TRA-F22x-A applications can be found in the engineering manual (section "Application modes: Wiring diagrams of outputs").

A typical connection of the TRA-F22x-A is shown below:



Selection of actuators and sensors

Temperature sensors:
Use Vector Controls NTC sensors to achieve maximum accuracy, see ordering list in section "Types and Ordering".

Binary auxiliary devices (e.g. fans, on/off valves, etc.)**:**
Do not directly connect devices that exceed specified limits in technical specifications – observe startup current on inductive loads.

Mounting and installation

For details see the TRA-F22x-A installation sheet no. 70-000957 (www.vectorcontrols.com).

Sealing of cable entries

Important!
All cable entries into the connection box must be sealed to prevent air draft, which could otherwise affect the sensors in the device and prevent correct measurements!

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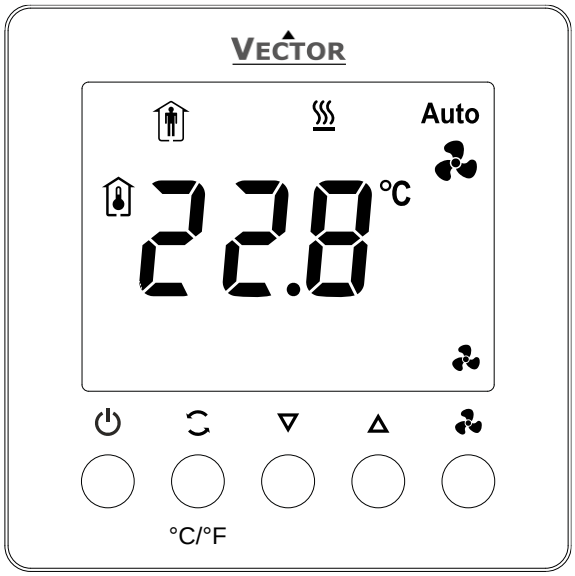
Display and operation

User interface



Button operation

Symbol	Function	Description
⏻	Operating mode (Return)	Operating mode selection (Comfort Mode, Economy Mode, Protection Mode) Menu navigation: Return to top menu
⟳	Controlling mode (Return)	Controlling mode selection (Heating Mode, Cooling Mode, Fan Only) Menu navigation: Return to top menu point Long press: Switch °C/ °F
▽	Down (-)	Adjust temperature set points and control parameters
△	Up (+)	Adjust temperature set points and control parameters
✣	Fan (Enter, Save)	Change fan mode (auto mode or fan speed) Menu navigation: Enter menu point Parameter change: Save parameter Long press: Display external input status

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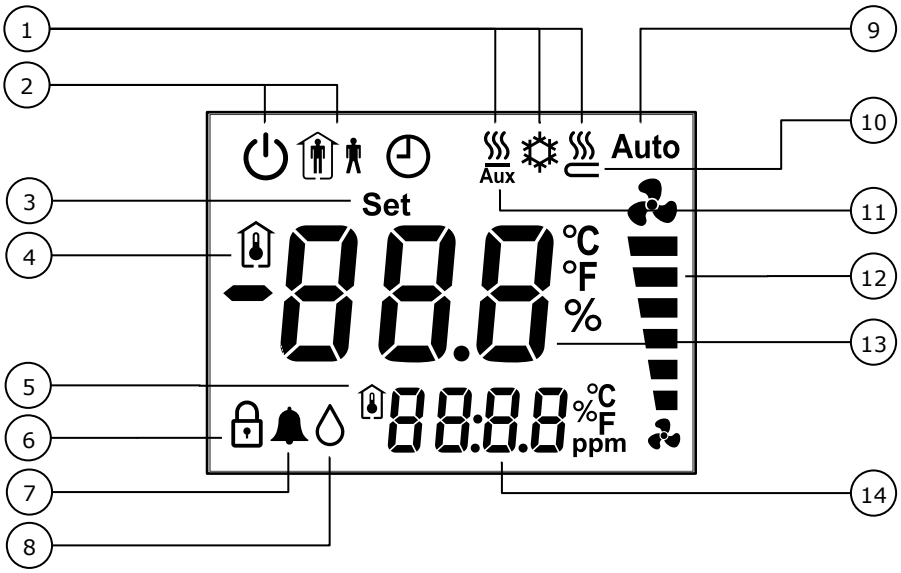
LCD Display



1	Controlling Mode (see section "Controlling modes")	8	Dew point alarm (see section "Alarm messages")
2	Operating Mode (see section "Operating modes")	9	Fan auto mode
3	Temperature set point or parameter setting active	10	Floor heating
4	Room temperature large digits	11	Electric heater
5	Room temperature small digits	12	Fan speed (low, medium, high)
6	Keys locked	13	Large digits (see section "Large and small digits")
7	Alarm (see section "Alarm messages")	14	Small digits (see section "Large and small digits", "Alarm messages", "Error messages")

ⓘ , % and ppm not used.

Operating modes

Display	Mode	Description
	Comfort (occupied)	The controller maintains the Comfort temperature set point defined with parameter P300. In Comfort mode, the fan can be set to auto or manual fan speed: Low, medium or high.
	Economy (unoccupied)	Controller maintains the Economy temperature set points defined with parameter P301 and P302.
	Protection	The controller runs in standby. The system is protected against overheating and frost if enabled with parameter P303 and P304.

Controlling modes

Display	Mode	Description
	Heating	Heating mode activates heater for temperatures below set point. When the heating symbol is blinking, the heating valve is turned on. Also, the electric heater or floor heating symbols are blinking if the heating valve is turned on.
	Cooling	Cooling mode activates cooling equipment for temperatures above the set point. When the cooling symbol is blinking the cooling valve is turned on.
	Fan Only	The bars between the fan symbols show the fan speed.

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Large and small digits

The large digits show the measured room temperature (default setting) or the Comfort temperature set point (configurable via parameter P101).

The small digits are off (default setting) or show the outdoor temperature (configurable via parameter P101). Also, alarms and error messages are shown on the small digits.

The room temperature and temperature set point are given in °C or °F (according to parameter P102).

Alarm messages

Alarm messages with alarm symbol are shown on the small digits.

Small Digits	LCD symbol		Alarm condition
ALA1		Alarm Dew point	Dew point alarm from input RT1/2 (parameter P500/P502 = 7)
ALA2		Alarm	Overheat protection alarm (only in Protection mode)
ALA3		Alarm	Frost protection alarm (only in Protection mode)
ALA4		Alarm	Electric heater overheat alarm
ALA5		Alarm	Monitoring alarm to notify user

Error messages

Error messages are shown on the small digits.

Small Digits	Error condition
Err1	Built-in temperature sensor error. Sensor is damaged (open or short circuit).
Err2	Temperature sensor RT1/RT2 error. The temperature sensor is not present. Verify wiring or parameter configuration. -99.9 is shown on large digits.
Err3	Digital input error. RT1/2 is not fully opened or closed (resistor between 1.25kΩ and 350kΩ). Verify wiring or parameter configuration.
Err4	Configuration error: A parameter is set in an invalid combination with another parameter. Err4 and one of the conflicting parameters are displayed alternating.

Temperature control

The controller measures room temperature with the built-in sensor or an external room temperature sensor and maintains the setpoint by controlling fan speed and the heating and/or cooling valve (or the electric heater). The following control outputs are available:

- on/off valve
- Modulating valve
- 3-position valve (only for 2-pipe systems)

The switching differential or proportional band is 2 °C for heating mode and 1 °C in cooling mode (configurable via parameters P400 and P401).

The default integral time is 5 minutes (adjustable via parameter P402 with 300 seconds as default value).

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Controller operation

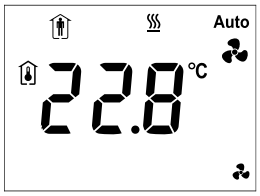
Enable or disable of economy mode and change of set point, fan speed, controlling mode or any user operation can be done via parameter settings (see parameter P103 to P108, default is ON and key lock disabled).

Operating mode

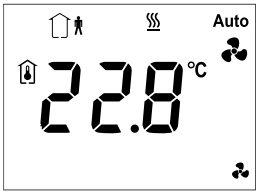
The controller operating mode can be switched between **Comfort** and **Economy Mode** with the operating mode button (⏻).

The controller is switched to **Protection Mode** by pressing the operating mode button (⏻) for 2 seconds.

Comfort Mode



Economy Mode



Protection Mode



If Economy mode is disabled (see parameter P103), the controller operating mode is switched between Comfort and Protection mode with the operating mode button (⏻).

Comfort Mode

In Comfort mode, the controller measures the room temperature via built-in sensor or external room temperature sensor and maintains the temperature of the Comfort set point by controlling the fan speeds and the heating and/or cooling valve (or the electric heater).

Economy Mode

In Economy mode, the controller measures the room temperature via built-in sensor or external room temperature sensor and maintains the temperature of the Economy set point by controlling the fan speeds and the heating and/or cooling valve (or the electric heater).

The temperature of the Economy set point depends on the controller configuration (see parameter P301 and P302).

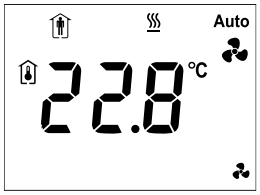
Protection Mode

In Protection mode, the system is protected against frost (default 5 °C, see parameter P304) and protected against overheating (default OFF) (see parameter P303).

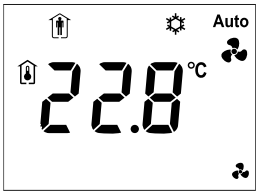
Controlling Mode

The controlling mode of the controller can be switched between **Heating Mode**, **Cooling Mode** and **Fan Only** by pressing the controlling mode button (↻).

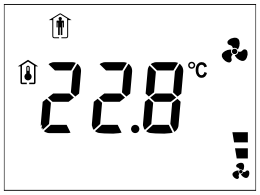
Heating Mode



Cooling Mode



Fan Only



Depending on the configured application (see parameter P200), cooling or heating can't be selected as controlling mode.

Heating Mode

In heating mode, the controller measures room temperature with the built-in sensor or an external room temperature sensor and maintains the requested temperature (Comfort, Economy or manual setpoint) by controlling fan speed and the heating valve (or the electric heater).

Cooling Mode

In cooling mode, the controller measures room temperature with the built-in sensor or an external room temperature sensor and maintains the requested temperature (Comfort, Economy or manual setpoint) by controlling fan speed and the cooling valve.

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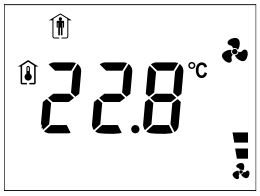
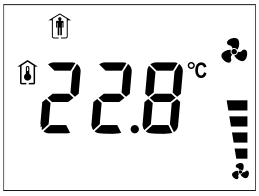
Fan Only

In fan only mode, the fan speed can be set with the up (△) or down (▽) button.
Heating or cooling is deactivated.

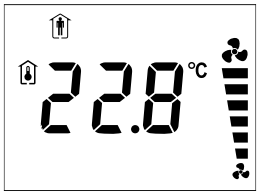
Fan Only (low)



Fan Only (medium)



Fan Only (high)

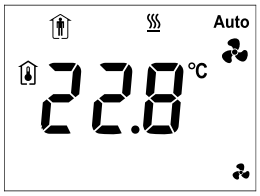


Note: The graphics shown are with 3-stage fan setting.

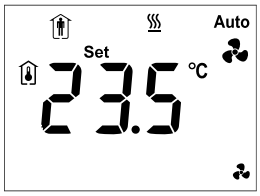
Temperature control

The comfort temperature set point can be adjusted in 0.5 °C (1 °F) steps with the up (△) and down (▽) button and saved either with the operating mode button (⏻), the controlling mode button (↻) or the fan button (✣). The Set symbol is shown on the display while changing the temperature.

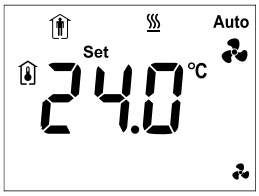
Comfort mode (example)



Temperature up



Temperature up

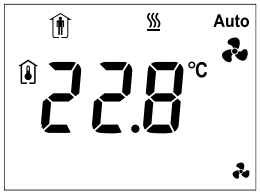


If the Economy mode is active, pressing the up (△) or down (▽) button will change the controller into the comfort mode.

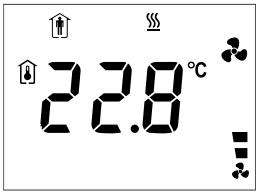
Fan speed

The fan speed can be changed between auto, low, medium and high fan speed by pressing the fan button (✣).
With analog fan, the fan speed can be changed between auto and 1 to 6.

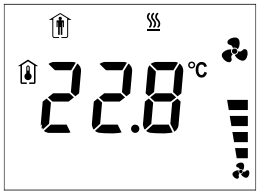
Fan auto



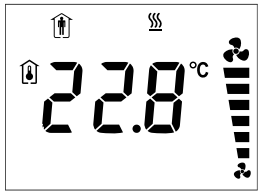
Fan low



Fan medium



Fan high



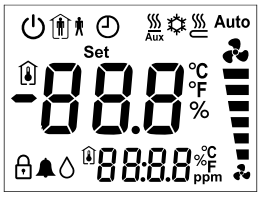
Controller start up

Normal start-up

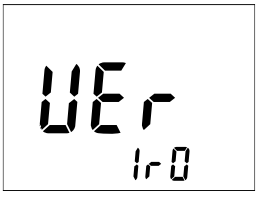
During start-up, the display backlight and all LCD segments are shown for two seconds. The software version and revision are then shown for two seconds on the small digits (format 1r0 = version 1, revision 0).

On the TRA-F221-A and TRA-F222-A, the address of the controller is also shown for two seconds.

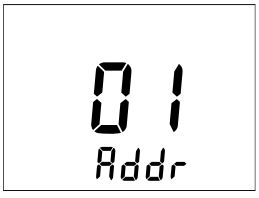
Display test



Software version (example)



Modbus address (example)



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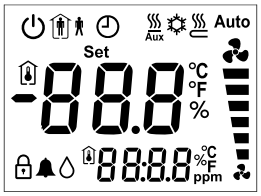
Start-up when the communication address is not set (after initial installation)

During start-up, the display backlight and all LCD segments are shown for two seconds. The software version and revision are then shown for two seconds on the small digits (format 1r0 = version 1, revision 0).
After the software version, the communication address can be set with the up (▲) or down (▼) button and stored with the fan (🌀) button.
To leave the menu without saving the communication address, press the operating- (⏻) or controlling mode (↻) button.

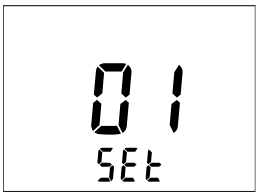
Display test

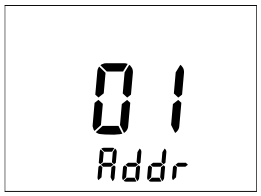


Software version (example)



Set Modbus address menu (alternating)





ⓘ If no address is entered, set mode is left automatically after 10 minutes. The address set menu will appear again on the next start-up.

After these steps the controller runs in comfort, economy or protection mode.

Power Failure

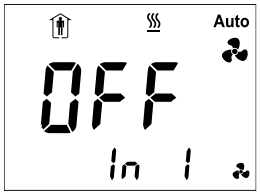
All temperature set points and parameters are automatically saved and do not need to be re-entered.

Upon return of power, the controller will start in Protection, Comfort or the same mode, according to the controller configuration (see parameter P110).

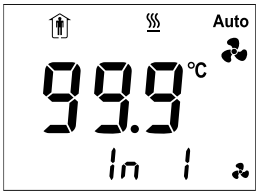
View input status (RT1/RT2)

Press the fan button (🌀) for minimum 3 seconds to enter the input menu. The input status of RT1 and RT2 is displayed in alternation.

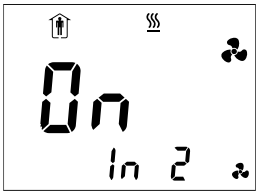
RT1 as digital input



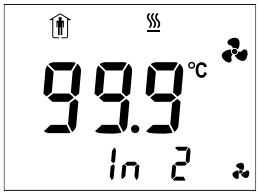
RT1 as temperature input



RT2 as digital input



RT2 as temperature input



The status of the inputs is displayed:

Condition	Large digits show	Small digits show
RT1 configured as NO/NC digital input	on/off	In 1
RT1 configured as NTC temperature sensor	Temperature in °C/ °F	In 1
RT2 configured as NO/NC digital input	on/off	In 2
RT2 configured as NTC temperature sensor	Temperature in °C/ °F	In 2

Press the Operating (⏻) or Controlling (↻) Mode button to leave the menu. After one minute the input menu is left automatically.

Additional Information

Conventions

The following presentation conventions apply to this manual:

DANGER
Indicates a hazard with a high degree of risk. Failure to observe this warning may result in immediate danger of serious injury or death.

Information
Further information, important operating instructions, other details.

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Reference to another document or other text passages in this document.

Abbreviations used

Abbr.	Meaning
AO (n)	Analog output
DI	Digital input
DO (n)	Digital output
GND	Ground
L	Line voltage
N	Neutral voltage
NC	Normally closed
NO	Normally open
NTC	Negative Temperature Coefficient
REF	Reference
RH	Relative humidity
RT (n)	Input (DI or NTC sensor)
STP	Shielded Twisted Pair (Cable)

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